‚Bridging Instruction to Learning' - Where we come from and where we need to go

A research strategy and its implementation in a cross-cultural video survey in Switzerland[1]

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If there is a prominent question that is currently enacted in the public discourse on education and that also drives quite a lot of international research on learning and instruction, it is the question of *educational outcomes and effectiveness*. *How can the process of schooling be mediated to educational attainments or products*.

The problem with this fundamental question is that it is far more complicated and intricate than most participants in the educational systems, and even some researchers, would like to see it - and have seen it in the past. While policy makers and teachers would simply like to know ‚what works' in schooling and instruction, educational researchers are still struggling with formulating the right question and with the design of its fruitful investigation.
Where do we come from, and where do we want to go in research with regard to filling the apparent gap between the process of schooling and its desired outcomes?

Figure 1 (Bridging Instruction to Learning)

Figure 1 shows how pedagogical theory and educational research have tried to answer this questions over the last century. Time does not allow me to go into Comenius' and Pestalozzi's ideas of bridging instruction to learning through unique pedagogical methods (I just remember that Pestalozzi was among the historical figures of great educators who were convinced of having found *the ultimate method of effective instruction*). In modern educational sciences, the loosly chronological list of changes in perspectives with regard to the *bridging* of instruction to learning outcomes begins with the *focus on teacher personality*. What are attributes, abilities and qualities that good teachers have, or prospective teachers should have? Versions of this approach still animate debates about teaching styles, about teaching as an art versus a science, or discussions about psychometric methods of teacher recruitment. Even if the approach has provided some interesting results, empirical findings „contradict the widely ac-

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cepted notion that ‚good instruction' is exclusively a result of teacher's aptitudes and skills" (Weinert, Schrader & Helmke, 1989, p. 907).

The major competing view to the static approach of teacher personality came up with the advent of the *process-product paradigm* (*Figure 2*) of educational research, with its two camps of emphasis – research on classroom interaction and climate, and research on instructional methods and quality (Reusser & Pauli, 1999; c.f. also Einsiedler, 1997). What teaching strategies are used by the most effective teachers and what classroom variables can be linked to student outcomes?

Figure 2 (Process Product Model)

The goal associated with process-product research was to find „any directly observable variables of teacher behavior" or classroom interaction that „consistently correlate with student achievement gains, in the hope of finding causal determinants of learning gains" (Weinert et al., 1989, p. 901). Despite numerous studies conducted within the tradition of the model and despite the vast number of results, the state of research could not be regarded as satisfactory. The main problem of the simple process-product model is the implicit assumption of a *direct impact of teaching on learning*, i.e. of deterministic relations between properties of teaching and products of learning - of relations that were thought of being *independent of persons, contexts, and domains.* This not only led to generally low correlations that needed to be qualified by other factors, but also to apparent *interactions, substitutions and compensations* of variables (suggesting more indirect and differential effects of instruction).
In contrast to this simple model „school learning is characterized by a great variety of relevant conditions ranging over long time spans" (Weinert et al., 1989, p. 899) and encompassing the different levels of the educational system. „Analyzing the impact of instruction in a comprehensive manner requieres multilevel and contextual analysis" (p. 900).

One fundamental reason for the dissatisfaction with the simple process-product approach, however, has been *learning theoretical* in nature. It has been the same reason which led to the emergence of our current understanding of learning, of *knowledge-based constructivsm*. While as from now on teachers were seen as self-reflective practitioners and knowledgeable experts, learners were conceived as self-regulatory, intentional subjects who build up their knowledge and skills on the basis of their goals and pre-knowledge, and on the available inputs and resources. On such ground, instruction could no longer be seen as simply *reacting on* or *being shaped by* instructional inputs,

as presumed by the process-product model, but as a process where any input from the classroom is internally *mediated and has to be transmuted by the individual in a process of appropriation*. Students – according to their cognitive and motivational states and reflections - are able *to use or not to use* learning opportunities provided by instruction. That is, instruction only has „indirect effects in stimulating and supporting students‘ learning activities without actually completely controlling them“ (Weinert et al., 1989, p. 907).

Where do we want to go with regard to a conceptual understanding of the conditions of educational outcomes? The major shift in emphasis during the last decade has been from a *simple process-product model* to a *cognitive mediational and systemic-contextual view of the relations between properties of schooling and student outcomes (*Winne, 1987*)*.

Core features of this multi-faceted approach of bridging the gap between instruction and learning resulted from several shifts of attention:

- from a variable-driven to a systemic approach of instructional quality;
- from a ‚flat‘ to a hierarchical, multi-level conception of the determination of school success;
- from an input-output model to a internal-processing and mediation view of cognition and action;[2]
- from a one-dimensional to a multi-criterial notion of objectives of instruction
- from a content-neutral view of teaching effectiveness to the inclusion of domain-specific aspects;
- from a conception of a direct impact to a conception of indirect effects of teacher behaviors on students‘ learning activities.

Figure 3 (Multilevel Mediational Framework)

Our multilevel mediational framework of instructional effectiveness depicted in *Figure 3 (*which has been derived from different pieces of work going back to Walbergs theory of educational productivity in 1981; Reusser & Pauli, 1999) takes into account both the multilevel character of the educational system *and* the multicriterial nature of instructional goals and processes. The shift in theoretical orientation could not have been effective without the concurrent development of new and powerful methodological tools of *data generation* (such as video surveys), and of *data analysis* allowing to

[2] Mediation in the sense that cognitive and motivational processes inside the heads of, e.g., teachers and students determine how they conceive learning opportunities and how and when they act

deal with the multilevel character of social life, i.e. with hierarchically organized data and its sophisticated statistical analysis (hierarchical linear modeling, structural equation modeling).

Seminal studies using approximations of such a framework have been conducted in the 1990ties in Munich (under the late Franz Weinert; see Weinert & Helmke, 1997) and – within the international TIMSS Video context - in Berlin under the leadership of Jürgen Baumert (c.f. Baumert, Bos & Lehmann, 2000). The enhanced German video study with its combination of classical survey data and observational data based on TIMSS Video is one of the first studies where innovative statistical techniques, especially hierarchical linear modeling, has been applied to questions of instructional quality.

Figure 4 (Design Swiss International Video Survey)

In the second part of this brief address, I shall give an impression of the design of our large-scale *Swiss-International video-based study* that we are conducting in collaboration with Swiss partners in Geneva and Bellinzona, and – regarding the video part, with Professor James Stigler from the UCLA (*Figure 4*).
Because of being among the high achieving countries in the Third International Mathematics study TIMSS, Switzerland is participating with 140 schools in the mathematics part of the cross-national TIMSS-R Video study - together with Australia, the Czech Rep, HK, the Netherlands and the US. The study, which is a major enterprise in international comparative research on schooling and instruction, involves videotaping and analyzing teaching practices in more than one thousend 8th grade mathematics and science classrooms in the various countries.

Before I briefly sketch the rationale and the enhanced design of our study, let me make a few remarks about *video as an innovative research tool.* What are the advantages of observational video data in instructional research?

According to Stigler, Gallimore and Hiebert (2000, p. 88ff; see also www.lessonlab.com) who introduced the ‚video survey' as a tool into instructional research „video greatly expands our ability to analyze complex human interactions such as those found in classroom learning and teaching. While live observations are limited to whatever an observer can record, videos can be repeatedly watched. They can be coded multiple times and from multiple perspectives." Because of its „concrete and vivid nature", video can help to develop a shared language about instruction – so-

mething that is really needed among educators, teacher educators and researchers - and provide opportunities to discover new analytic tools and categories. Video is far „less theory bound“ than most other methods of data collection, and it has a longer shelflife than other kinds of data. Video allows for interdisciplinary collaboration and for an integration of qualitative and quantitative methods of analysis in educational research.

What benefits do international studies on schooling have for the development of our *theoretical understanding of instructional quality*? Recent developments in comparative research on learning and instruction (such as PISA, TIMSS and TIMSS Video) show that not only schooling *effectiveness*, as measured by academic achievement, but also the *conditions, patterns and practices of teaching heavily differ across cultures and countries.* Large-scale international video surveys provide us with a challenging new approach for refining and validating our images and concepts of instructional quality. There is an open question, whether cross-cultural analyses of classroom videos will allow us, as researchers, to move *beyond* a ‚German‘, ‚Dutch‘, ‚Swiss‘, ‚American‘, ‚Czech‘, or ‚Japanese‘ interpretation of ‚good‘ or ‚effective‘ teaching.

> For example, it is not a trivial question to make sure that we all understand the same if we talk, let’s say, about *student-oriented learning*? - What are reasonable goals of comparative instructional research with regard to cultural criteria and models of quality and effectiveness? Can a basically *culture-free, or at least culture-fair, universal understanding of quality* be achieved at all? Teaching has many faces, i.e. also many faces of quality. Can we compare those faces between different cultures? Can we - *independent of, or accounting for cultural variation* – find a shared conceptual language with regard to instructional quality and goals? And when we have developed as scientists a descriptive language, can we translate it back into the natural languages of each country? The following are the possible responses of an optimist and of a pessimist on this question:
>
> *The optimist’s view might go as follows:* Yes, it is possible - to move, e.g. beyond an ‚American“ interpretation of teaching. What we have to do is rigorous control for cultural factors in the multilevel analysis of the educational system, e.g. by using modern statistical techniques in multi-level data analysis, and, by taking the reliability issue in cross-cultural video coding very seriously. We thus need to make sure in our code development and our training that all informed viewers of videos see the same, or similar things and make similar judgments. If we master the reliability issue, then

we will be able to incorporate multiple perspectives into our models and interpretations.

What is it that the pessimist might say? May be it's possible to code superficial things reliably, but what about deeper level cultural patterns of teaching? The pessimist could say: If we take the multi-level character of educational systems seriously, it might hardly be possible to empirically compare countries with regard to a subject – namely *instruction* - which itself is a systemic cultural construction. Teaching is not just teaching; what we observe in classrooms is – always and necessarely - *culturally enabled teaching*. It is the cultural milieu that enables certain patterns of teaching and schooling. Culture is always present, and comes in at any level when we observe lessons and discuss instructional issues - and we can't get it out of our descriptions and models.

We assume that the integration of multiple methods and their respective results, of the descriptive, cross-cultural video surveys and the more classical research on educational quality and effectiveness, not only will enhance our conceptions about the multifaceted cultural activity of schooling and instruction, but also will bring us closer to a more intersubjective and culture-fair understanding of its effects and qualities.

The three-fold challenge of video-based research with its possibilities to gather, archive, and analyze large quantities of classroom videos, thus, is to

(a) combine in a integrated, multi-method approach classical survey data with observational data of classroom videos,

(b) tie the quality of educational outcomes to variations in the quality of instruction, and to

(c) build arguments for a theory of instructional design and of teaching accounting for both individual prerequisites and cultural conditions for the development of multidimensional educational chievements and competencies.

The *Swiss Video study* is a significant extension of the design of the international TIMSS-R video survey directed by Jim Stigler at the University of California at Los Angeles.[3] Complementary to the international study (Stigler, Gallimore & Hiebert, 2000), the Swiss study is pursuing the following goals:[4]

[3] The study is being conducted in collaboration with Swiss partners in Geneva and Bellinzona, and – regarding the video part, with Prof. Jim Stigler from the University of California, Los Angeles (www.lessonlab.com).

[4] Printed in *italique* are the goals that are specific of the Swiss study.

Theoretical

- Describe mathematics teaching in Swiss classrooms; reveal a national-level portrait of teaching processes
- *Compare systems, patterns of teaching within Switzerland and across countries (commonalities, differences)*
- *Investigate to what degree student outcomes are tied to identifiable teaching strategies and to patterns of instructional quality: How many faces does good teaching have?*

Practical

- Create a digital library of images of teaching to be used in the professional development of teachers and schools
- Develop video-based knowledge tools for teacher education
- Stimulate discussion of instructional practices among (teacher) educators, policy makers, and the public

Methodological

- Develop new teaching research methods
- *Test of an integrated research design where multilevel data on teacher, student and context characteristics are combined with observational video data.*

The main difference to the international study is that the Swiss study consists of a *combination of a national Video survey with broad measurement of student, teacher and context variables*. Videotaping of one 8th grade mathematics lesson in 156 schools (91 German speaking, 38 French speaking, 27 Italian speaking; three school tracks) was supplemented by extended standardized teacher and student questionnaires, longitudinal achievement and cognitive ability testing. The school sample is truly representative for Switzerland as a multi-lingual country and for its main cultural regions.
The research design follows a *multilevel, multiperspective, multi-knowledge, multi-method and multi-goal* approach of instructional quality and effectiveness (5-M approach, see *Figure 5*) in accordance with the framework of schooling quality and effectiveness depicted in *Figure 3*. [5]

[5] A supplementary study that we are conducting (in collaboration with *Eckhard Klieme*, Frankfurt, consists of an in-depth comparison of the systems and quality of mathematics teaching in Germany and in Switzerland.

Figure 5 (5-M-Approach)

Multilevel: According to the assumption that schooling is always *enabled* by a culture and, thus, the quality and effectiveness of instruction depends on a complex interplay of variables on multiple levels of the educational system, data on various levels of the Swiss system of education were collected.

Multiperspective or *multi-source*: Teachers and students are intentional subjects who are able to regulate their behavior on the basis of their insights, their knowlege and beliefs. Thus, it seems imperative to not only collect data from the perspective of outside experts but to combine and contrast the inside views and perceptions of teachers and students with the perspectives of independent observers on central features of instruction. Comparison of students‘ and teachers‘ perceptions of the observable features of instruction is also a promising way to explain differential effects.

A Multi type of knowledge approach is taken as we assume that it is important to also get at different types of knowledge. What is meant by types is that the knowledge base underlying the process of teaching is formed by both explicit and tacit knowledge structures. How does the subject-related and the pedagogical and didactical knowledge look like that guides the thinking of teachers, and that is enacted in their didactical practices, patterns and rituals of instruction? What kinds of knowledge (including beliefs and orientations) constitute the deep structural level of particular pedagogical arrangements and cultural milieus of schooling and instruction?

Multi-method: With regard to data collection and analysis, the Swiss video survey is focusing on an integration of multiple methods and their respective results. With respect to data generation, the video survey is combined with classical survey methods. Regarding data analysis, multiple quantitative and qualitative techniques will be used in order to integrate observational data from classroom videos with data gathered from classical testing and from questionnaires.

Multi-Goal: Finally, a *multi-criterial* approach is taken with respect to the multiple goals of instruction. That is that research instruments were designed to be sensitive to the multi-dimensional nature and aims of instruction (i.e., not only to mathematics achievement but as well to dimensions of motivational orientations, domain-interest, social and learning strategies, etc.).

The *current state of the study* is that data collection has been terminated this summer. Video tapes are being analyzed to reveal a national-level portrait of teaching processes

– the first ever done – in multi-cultural Switzerland. Preliminary findings have been presented at this conference (Reusser, Pauli, Grob, Waldis, Hugener & Krammer, 2001). Let me conclude with a remark on one of them.

Special emphasis in our study was put on the development of instruments that cover *the broad range of practices of instruction including features and methods associated with student-oriented, adaptive and individualized (personalized) teaching, and that are sensitive to the diverse goals in the cognitive, affective and social domain of education*. As we have reasons to assume from previous studies on learning environments in Swiss-German secondary schools (c.f. Stebler & Reusser, 2000), teaching in Switzerland follows more than one basic script or choreography, and also more than one instructional goal (e.g. growth of academic achievement). It seems that at least two scripts, a rather traditional one of *direct instruction*, and a more *progressive* one - using a set of extended forms of teaching - *coexist* in Swiss classroom instruction. Thus an explicit goal of our study is to overcome two still visible biases, or deficits of international research on instructional quality: The bias toward the investigation of direct teaching as the most effective approach of instruction, and the one-dimensional view of growth of academic achievement as the only relevant goal of basic level schooling.

Preliminary findings of our study (Reusser et al., 2001) confirm that there is more than one basic approach of mathematics instruction in Switzerland, and that there exists considerable variation within these approaches. That is, not homogeneity but different teaching profiles seem to be be a dominant feature of mathematics instruction in Switzerland. An important aspect from our multicriterial view on instruction is that both more traditional *and* more progressive profiles of didactical practices go along with high student achievement, and with a generally positive orientation towards learning. As in a previous study, we did not find any significant differences between achievement level in mathematics and *general* didactical approach (e.g. more ‚traditional' or ‚progressive'). Effective and qualified teaching apparently has more than one face in Switzerland.

Figure 6 (Results Illustrated: Differences in Student Orientation)

This finding is not trivial as you might agree after looking at a small piece of a completed comparative analysis of video-based ratings of the instructional quality of 60 randomely selected mathematics lessons in the german part of Switzerland and in Germany (Clausen, Klieme & Reusser, 2001). *Figure 6* shows a significant difference

in student orientation or individualization of teaching between Switzerland and Germany, a difference in favour of Switzerland. Whether such differences in measurement of instructional quality can contribute to the explanation of the large and significant achievement level differences between Swiss an German 8th grade students in the TIMS study of course still remains a widely open question.

Part of the innovative potential of our study that we are doing with collegues from Germany, and of the other national and international studies that we are involved in, is that the explanatory power of factors related to the significant role of teachers as designers of powerful and effective learning environments for children and adult learners might become more clearly visible – especially if we extend our reserach designs in the aforementioned direction, and if we include significantly refined measurement of the didactical quality of subject-matter related teaching.

All too long, there has been a bias towards the *neglect of instructional variables in developmental research and in research on school effectiveness* – compared, e.g., to variables known as powerful predictors of educational success, such as cognitive ability, and family background.[6] It is the responsibility of our society which is dedicated to research on learning and instruction to contribute to a change of this unbalanced view on the power of teachers and teaching.

Conducting national and cross-national research on teaching and school effectiveness is costly in terms of time and – I have to mention with regard to our own projects – financial resources. We very seldomly have these resources available to conduct *basic empirical research* that is needed in a field that is of significance to the development of our democratic knowledge societies. If we take into account the high expectations that modern institutions of both elementary and higher education will have to meet in

[6] A few prominent examples of such neglect of instructional variables in research on school effectiveness (quoted after: Weinert, Schrader & Helmke, 1989):

- COLEMAN REPORT (Coleman et al., 1966): "... that school brings little influence to bear on a child's achievement that is independent of his background and general society context." (p. 325)
- JENCKS ET AL. (1972): "The character of schools' output depends largely on a single input, namely, the characteristics of the entering children. Everything else — the school's budget, its policies, the characteristics of the teachers — is either secondary or completely irrelevant." (p. 256)
- GOOD, BIDDLE & BROPHY (1975, p. 3): "Do schools or teachers make a difference? No definite answer exists because little research has been directed on the question in a comprehensive way."
- HAERTEL, WALBERG & WEINSTEIN (1983, p. 75): "... classroom learning is a mulitplicative, diminishing-returns function of four essential factors — student ability and motivation, and quality and quantity of instruction — ... Each of these essential factors appear to be necessary but insufficient by itself to classroom learning; that is, all four of these factors appear required at least at minimum levels for classroom learning to take place. It also appears that the essential factors may substitute, compensate, or trade-off for one another in diminishing rates of return ..."

the near future, we need more basic research on the quality and effectiveness of our educational systems.

To do this, we not only need, as a part of the contract between science and society, responsible researchers ready and being able to conduct state-of-the art research, and to draw national portraits on the quality and effectiveness of our educational systems. We also need the societal support in terms of resources and infrastructure.

Not only for the sake of our students and the future generations but just also because of the immense economic costs of our schooling systems: *Teachers and teaching must matter, instruction must make a difference*. High quality research on its outcomes and effectiveness is a necessary prerequisite.

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Bridging Instruction to Learning
... Where we come from and where we want to go ...

What bridges the CONCEPTUAL GAP between

SCHOOLING and **EDUCATIONAL OUTCOMES?**

Processes of Schooling → *What are the* **Mediational Factors?** → **Products** of Educational Effectiveness

1628 **Comenius***: Didacta magna*

1800 **Pestalozzi**: *‚The Method‘*

1900/1960 **Teacher personality**
Charisma, attributes and abilities of good teachers

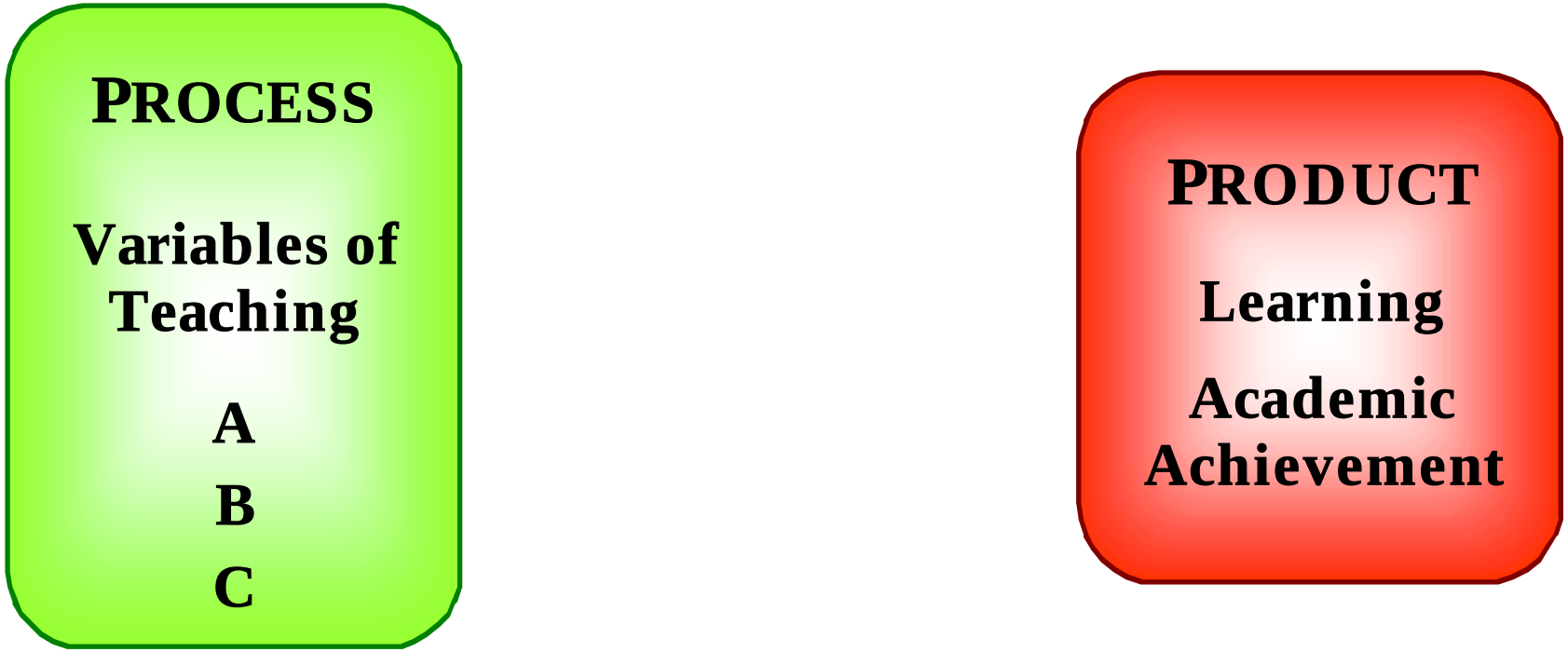
1960/1990 **Process variables of effective instruction**
(Simple Process-Product-Model)
- Instructional quality: Effective teaching strategies
- Classroom climate and interaction

1980/2000 **Teacher knowledge and expertise; Students as Intentional Learners**
- Research on the reflective professional
- Research on (co-) constructive and self-regulatory student learning

PRESENT **Multilevel and multicriterial framework of teacher- and student-mediated effectiveness**
(Extended Process-Mediation-Product-Model)

Figure 1

Simple Process-Product Model

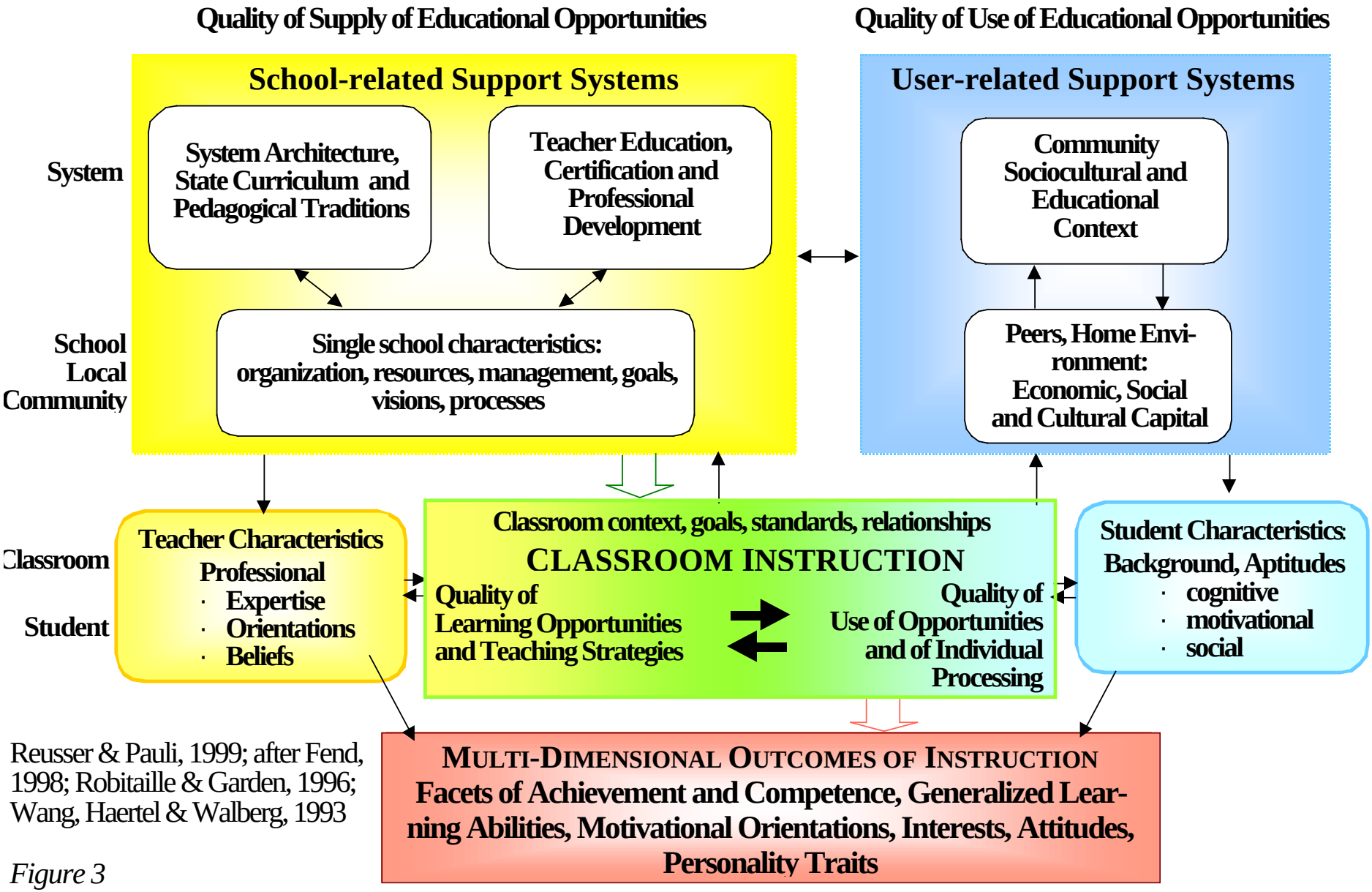


A, B, ... : Properties of, e.g., classroom management, quantity and pace of instruction, clarity and structure of presentation, task orientation, positive social interaction, classroom climate

(c.f.: Brophy & Good, 1986; Wang, Haertel & Walberg, 1993)

Figure 2

Multilevel Mediational Framework of Instructional Quality and Effectiveness



Reusser & Pauli, 1999; after Fend, 1998; Robitaille & Garden, 1996; Wang, Haertel & Walberg, 1993

Figure 3

Swiss-International Video Survey

on the Quality of Mathematics Instruction in Different Teaching-Learning Cultures

Three interlinked studies

I ***Swiss participation in the cross-national TIMSS-R Video Study of 8th grade mathematics teaching***.
Together with Australia, the Czech Republic, Hong Kong, the Netherlands and the United States. In *Switzerland*, 140 schools (other countries: 100) are sampled. One lesson is videotaped during the school year. A teacher questionnaire supplements data collection (Director of the international Study: *Jim Stigler*, UCLA).

II ***Enhanced multilevel study in the main linguistic parts of Switzerland (German, French, Italian)***.
Combination of large-scale video and survey data (n= 160 schools). Videotaping is supplemented by extended teacher and student questionnaires, achievement and cognitive ability testing.

III ***In-depth longitudinal study on instructional quality and mathematical understanding***
in collaboration with the MPI of Educational Research, Berlin (*Eckhard Klieme*). Combination of extended videotaping, teacher and student interviewing/ questionning and elaborated forms of student-outcomes testing.

Swiss study director: *Kurt Reusser*, Zurich; studies I+II: in coll. with *Emanuele Berger* (Bellinzona) and *Norberto Bottani* (Geneva)

Figure 4

5-M Approach to Data Collection and Analysis

Employed in the Extended Design of the Swiss Video Survey

(1) MULTI LEVEL
- Interplay of variables on multiple levels
- Data collection on *system, school, classroom, individual level*

(2) MULTI PERSPECTIVE
- *Insiders*‘ characteristics and views of teaching and schooling: Perceptions, knowledge, orientations, beliefs, aptitudes of teachers and students
- *Outsiders‘/Observers*‘ views of teaching and schooling: Trained experts, researchers, focus groups

(3) MULTI TYPE OF KNOWLEDGE

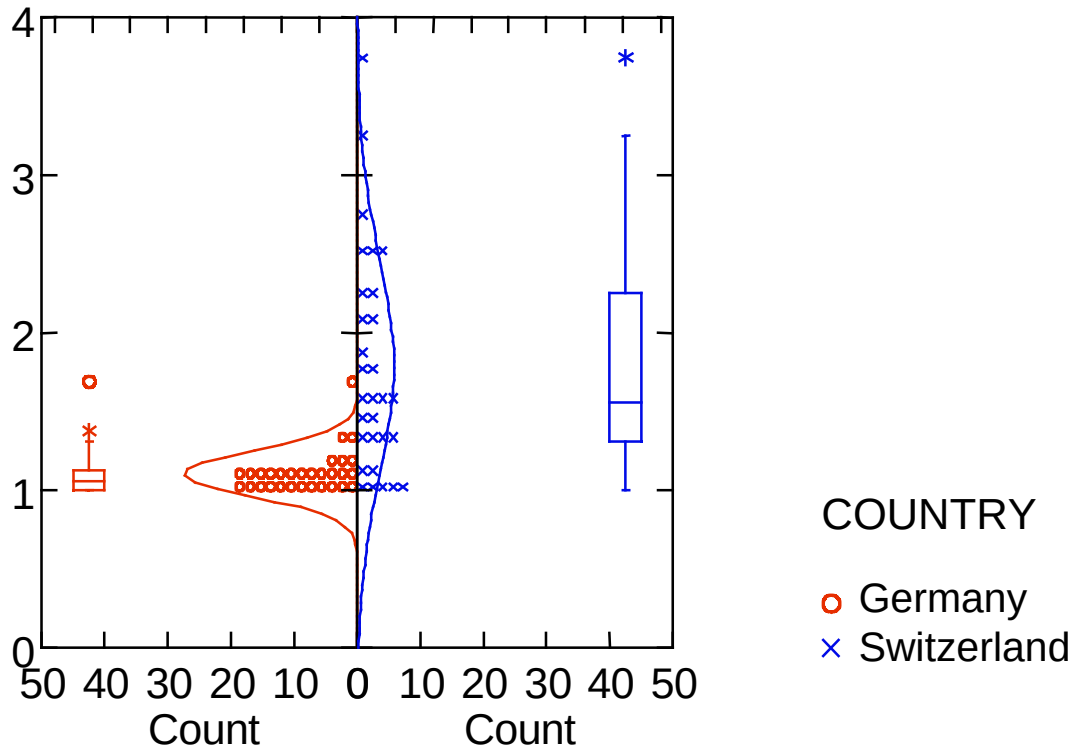
KNOWING THAT, HOW, WHEN, WHERE AND WHY ...
- Knowledge enacted in didactical practices, patterns
- General and subject-related didactical knowledge
- General psychopedagogical knowledge and beliefs

(4) MULTI METHOD
- *Data generation*: Videotaping of classroom instruction, standardized questionnaires and tests, verbal reports
- *Data analysis*: Integration of qualitative and quantitative methods; from bivarate to multivariate on multiple hierarchical levels

(5) MULTI CRITERIA
- Multi-dimensional view of *goal criteria* of instruction
- Focus on mathematics achievement *and* on motivational orientations, subject-interest, social and learning strategies, properties of the developing personalities of students

Figure 5

Results Illustrated:
Differences in Student Orientation



Swiss lessons show a higher level of student oriented, individualized instruction.
For lessons from the German sample almost no Individualization is found.
Similar but weaker results for student orientation and positive dealing with mistakes.

Taken from: M. Clausen, E. Klieme & K. Reusser: Video-based ratings of instructional quality. Presentation at the 9th European Conference for Research on Learning and Instruction. Fribourg, September 1st 2001.

Figure 6